An Overview of Stated Preference Choice Experiments Using a Recreational Use Case Study

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Use Vs. Non-Use Valuation

- **Use Valuation**
  - **Possible to value using revealed preferences**
  - **If RP not possible, still far less hypothetical**
  - **Extent of market easier to determine**
  - **Familiarity with the good**
    - **Payment vehicle easier to frame**
    - **Framing and context less of an issue overall**
- **Non-Use Valuation**
  - **Definitely not traded in markets**
  - **No revealed preferences to examine, with the exception of hedonic models**
  - **Relatively low familiarity with the good**
    - **Payment vehicles can be quite tricky**
    - **Framing and context a major issue as the instrument may provide the only exposure to the good**

The MRFSS

AKA the Marine Recreational Fisheries Statistical Survey

- Designed to estimate catch, effort and participation using a creel survey and an RDD survey.
- Economic data periodically collected using add-on surveys
  - Expenditure/impact
  - Revealed preference valuation
  - Stated preference valuation
    - Conjoint (or Stated Preference Choice Experiment – SPCE)
    - Contingent valuation
    - Contingent behavior
  - Participation/demographic
  - For hire cost earnings

Revealed Preference vs. Stated Preference Techniques (or Why I Use SP Techniques)

- RP Uses
  - Damage assessment
  - Effects of closures
  - Large regional or national total value estimates
- Limitations
  - Little spatial/temporal variation in important policy variables
  - Cannot predict effort changes
  - Cannot predict substitution

Steps to Develop an SPCE

- Define Attributes
  - Qualitative research driven
  - Policy driven
  - Theory driven
- Develop experimental design
- Test qualitatively and quantitatively
- Iterate

Angler Utility

- **Angler utility**

$$U_j\left(X_j,\varepsilon_j\right)=V_j\left(X_j\right)+\varepsilon$$

- **An angler will choose trip j if;**

$$V_j\left(X_j\right)+\varepsilon_j\geq V_k\left(X_j\right)+\varepsilon_k, j\in S, \forall k\in S$$

- **Generalize to include sub-sets of the global choice set S;**

$$V_j\left(X_j\right)+\varepsilon_j\geq V_k\left(X_k\right)+\varepsilon_k, j\in S, \forall k\in S_i, S_i\subset S$$

Just What Do You Include in X?

- **Cost**
  - **Travel or trip cost for recreational surveys**
  - **Program or policy cost for non-use values**
- **Brand – species target in our recreational example**
- **States of nature attributes**
  - **Air and water quality**
  - **Catch and keep rates, etc.**
- **Policy attributes**
  - **Implicitly assumes two effects in utility – policy effect and outcome effect**
  - **Some controversy here**

Conditional Logit

$$P_i(j) = P(j \mid j \in S) = \frac{e^{V_j(X_j)}}{\sum_{k \in S_i} e^{V_k(X_k)}}$$

- **Maximum likelihood estimator covariance matrix**

$$\Sigma = (Z' P Z)^{-1} = \left[\sum_{j=1}^{S} \sum_{k=1}^{S_i} z'_{kj} \, P_{kj} z_{kj} \right]$$

$$z_{kj} = x_{kj} - \sum_{i=1}^{S_i} x_{ij} P_{ij}$$

2003-2004 Mail Add-On Survey

B3 **Please look at the table, compare all the features of each fishing trip, and then answer the question below.**

Definitions

- **Target species:** The species of fish you expect to catch on the trip.
- **Total number of fish caught per trip:** Your expected total catch of the target species. Your total may be restricted by the bag limit and/or the minimum size limit.
- **Bag limit:** The number of the target species that you are legally allowed to keep per fishing trip.
- **Minimum size limit:** The minimum length of the target species that you may keep. You are not legally allowed to keep fish that measure less than this length.
- **Catch at or above minimum size:** Your expected catch of the target species that are equal to or longer than the minimum size limit.
- **Trip cost:** Includes your personal share of the costs associated with gas, wear and tear on your vehicle, tolls, ferries, parking, access fees, food, ice, bait, and fishing equipment used on this trip.
- **Other fish:** Any fish you might expect to catch on a fishing trip for the target species (not including the target species).

Features	Trip A	Trip B	No Trip
Target species	Grouper	King Mackerel	Do something else, but not take a saltwater fishing trip.
Total number caught per trip	6 Grouper	1 King Mackerel	
Bag limit	3 Grouper	5 King Mackerel	
Minimum size limit	20 inches	28 inches	
Catch at or above the minimum size	6 Grouper	1 King Mackerel	
Trip cost	$140	$140	
Catch of target species you are legally allowed to keep	3 Grouper	1 King Mackerel	
Catch of other fish you are legally allowed to keep	3 fish	6 fish	

Which trip would you choose? Please select only one.

- ○ **Trip A**
- ○ **Trip B**
- ○ **No Trip**

Experimental Design

- Avoid fold-over designs
- 7 attributes across a paired choice experiment yields a full factorial with 85 million possible combinations.
- All 2nd order and higher effects can be estimated if a fractional factorial is balanced and orthogonal

Experimental Design Criteria

- Balance = all attribute levels appear equally often
- Orthogonality = estimable effects are uncorrelated
- Balance and orthogonality difficult to achieve
  - With large factorials
  - With utility/logic constraints
- Need an efficiency criterion

D-Efficiency

- **D-error**

$$|\sum|^{\frac{1}{K}}$$

- **Linear D-efficiency**

$$100 \times \frac{1}{S\,|\left(X'X\right)^{-1}|^{\frac{1}{p}}}$$

Descriptive Statistics

Variable	Levels Used in Experimental Design	Mean	Standard Error
K_BAG	1, 2, 3, 5	2.70	0.0227
D_BAG	6, 10, 15, 20	12.98	0.0857
G_BAG	1, 2, 3, 6	3.00	0.0295
R_BAG	1, 2, 3, 5	2.86	0.0238
TC	$45, $70, $105, $140	59.92	0.3324
OTHER	1, 3, 6	2.22	0.0148
K_KEEP	1, 2, 3, 5	1.76	0.0153
D_KEEP	1, 3, 6, 10, 15, 20	6.70	0.0851
G_KEEP	1, 2, 3, 5, 6	1.97	0.0211
R_KEEP	1, 2, 3, 5	1.90	0.0173
K_TOTAL	1, 2, 3, 5	3.43	0.0230
D_TOTAL	1, 3, 6, 10	6.69	0.0541
G_TOTAL	1, 2, 5, 6	4.42	0.0302
R_TOTAL	1, 2, 3, 5	3.47	0.0240
K_SIZE	20", 24", 28"	24.00	0.0504
D_SIZE	18", 20", 24"	20.69	0.0403
G_SIZE	18", 20", 24"	20.71	0.0395
R_SIZE	16", 18", 22"	18.65	0.0400
K_LEGAL	1, 2, 3, 5	2.42	0.0217
G_LEGAL	1, 2, 3, 6	3.12	0.0319
D_LEGAL	1, 3, 6, 10	4.37	0.0522
R_LEGAL	1, 2, 3, 5	2.55	0.0235

Catch and Keep Model Results

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]
TC	-0.0023	0.0004	-5.8300	0.0000
OTHER	0.1108	0.0076	14.5240	0.0000
K_TOTAL	0.2745	0.0189	14.5000	0.0000
G_TOTAL	0.1785	0.0141	12.6560	0.0000
D_TOTAL	0.0495	0.0091	5.4200	0.0000
R_TOTAL	0.1429	0.0194	7.3640	0.0000
K_KEEP	0.2589	0.0348	7.4330	0.0000
G_KEEP	0.2851	0.0276	10.3430	0.0000
D_KEEP	0.0201	0.0076	2.6560	0.0079
R_KEEP	0.2893	0.0327	8.8520	0.0000
K_LEGAL	0.2923	0.0241	12.1450	0.0000
G_LEGAL	0.1280	0.0161	7.9350	0.0000
D_LEGAL	0.0491	0.0111	4.4160	0.0000
R_LEGAL	0.1876	0.0229	8.2060	0.0000
LogL		-7223.69		
LogL no coefficients		-17601.97		
LogL constants only		-22945.64		
Adjusted R-squared		0.58935		

Policy Attribute Model Results

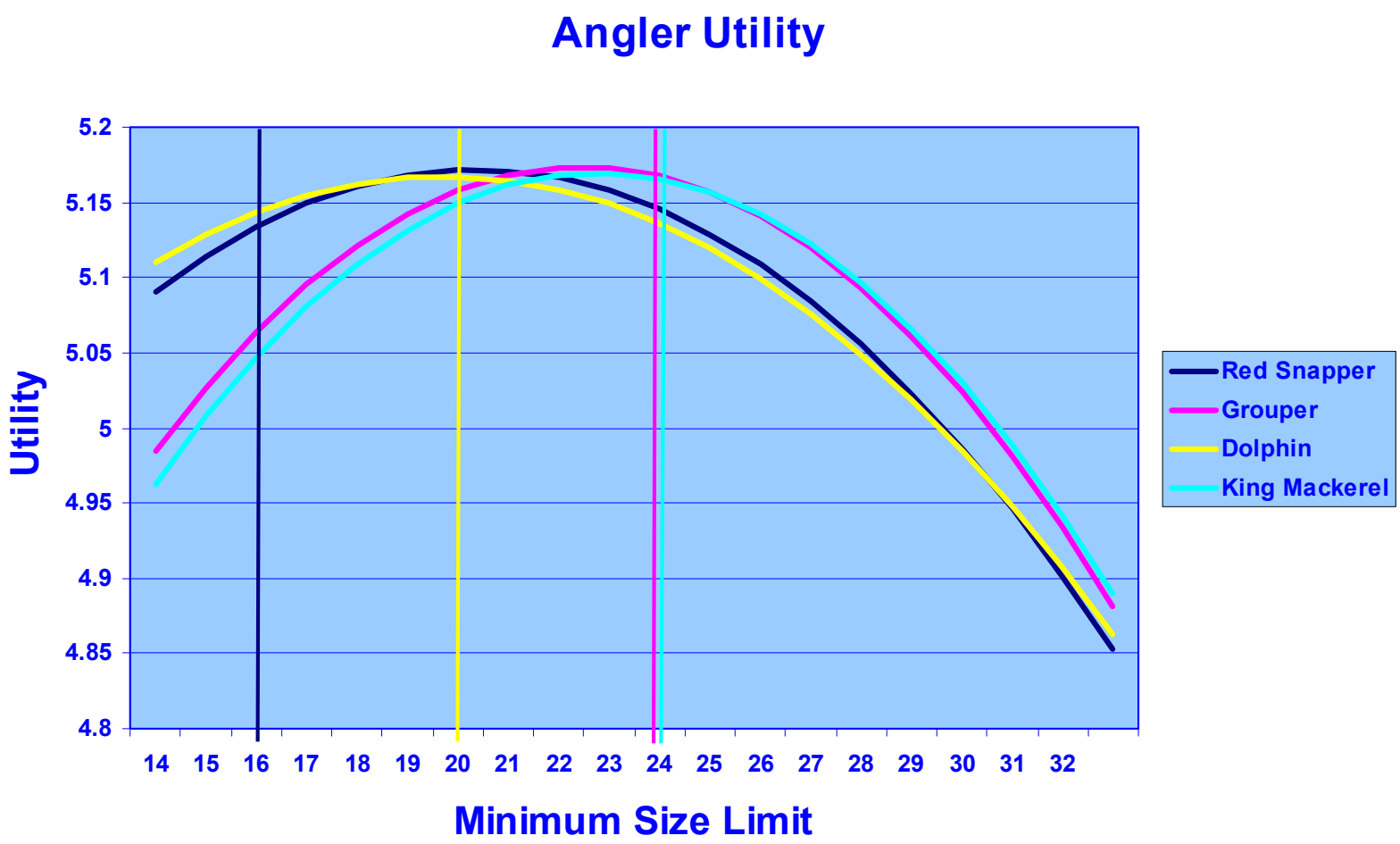
Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]
K_BAG	-0.0059	0.0215	-0.2750	0.7829
D_BAG	0.0208	0.0068	3.0570	0.0022
G_BAG	0.1079	0.0177	6.0910	0.0000
R_BAG	0.1450	0.0227	6.3920	0.0000
TC	-0.0053	0.0005	-11.5250	0.0000
OTHER	0.0617	0.0083	7.4620	0.0000
K_SIZE2	-0.0027	0.0005	-5.8320	0.0000
D_SIZE2	-0.0017	0.0008	-2.2980	0.0216
G_SIZE2	-0.0026	0.0007	-4.0110	0.0001
R_SIZE2	-0.0020	0.0008	-2.6300	0.0085
K_SIZE	0.1223	0.0134	9.1020	0.0000
D_SIZE	0.0685	0.0191	3.5880	0.0003
G_SIZE	0.1189	0.0161	7.3670	0.0000
R_SIZE	0.0816	0.0177	4.6040	0.0000
K_LEGAL	0.2923	0.0241	12.1450	0.0000
G_LEGAL	0.1280	0.0161	7.9350	0.0000
D_LEGAL	0.0491	0.0111	4.4160	0.0000
R_LEGAL	0.1876	0.0229	8.2060	0.0000
LogL		-7129.98		
LogL no coefficients		-17601.97		
LogL constants only		-22945.64		
Adjusted R-squared		0.59448		

Current Regulation for Base Case

	Current Bag Limit	Current Size Limit
GROUPER	5	24"
RED SNAPPER	4	16"
DOLPHIN	10	20"*
KING MACKEREL	2	24"

*only in force in Georgia's state waters (< 3 miles), but proposed for Federal waters

Minimum Size Limit Attribute



Policy Simulations: Welfare & Impacts

		1: 50% Reduction in Bag		2: Reduction in Keep from 4 to 2 Fish		3: Reduction in Keep from Sample Values to 2 Fish		4: 50% Reduction in MRFSS Average Keep	
Target Species	2003 Effort	Share Change	Effort Change	Share Change	Effort Change	Share Change	Effort Change	Share Change	Effort Change
Grouper	32,418	-1.05%	-340	2.78%	900	1.50%	485	0.59%	191
Red Snapper	18,891	-5.18%	-979	-11.66%	-2,203	-5.64%	-1,066	-2.65%	-500
King Mackerel	35,851	1.83%	656	2.90%	1,038	1.16%	417	0.59%	211
Dolphin	17,556	2.51%	441	2.84%	499	1.39%	244	0.68%	119
No Trip		1.90%	-359	3.39%	-640	1.59%	-300	0.79%	-150
Net Effort Loss			-581		-405		-220		-129
Welfare Effects									
CV per Trip			$27.99		$132.28		$69.66		$25.86
Welfare Loss			$528,759		$2,498,901		$1,315,947		$488,521
Expenditures and									
Average Trip Cost			$49.12		$49.12		$49.12		$49.12
Loss of Trip			-$28,545.90		-$19,898.60		-$10,786.37		-$6,345.78
Sales Impacts			-$64,028.39		-$44,572.87		-$24,161.48		-$14,214.55
Income Impacts			-$21,716.61		-$15,122.94		-$8,197.64		-$4,822.79
Job Losses			-0.74		-0.52		-0.28		-0.16

Discussion

- **Success!!**
- **Timely – all four species have changes in their management plans pending**
- **Expensive and slow – but I think we could speed it up significantly**
- **Could easily include more brands**
- **Custom likelihood function needed for nested model**